FIG.1

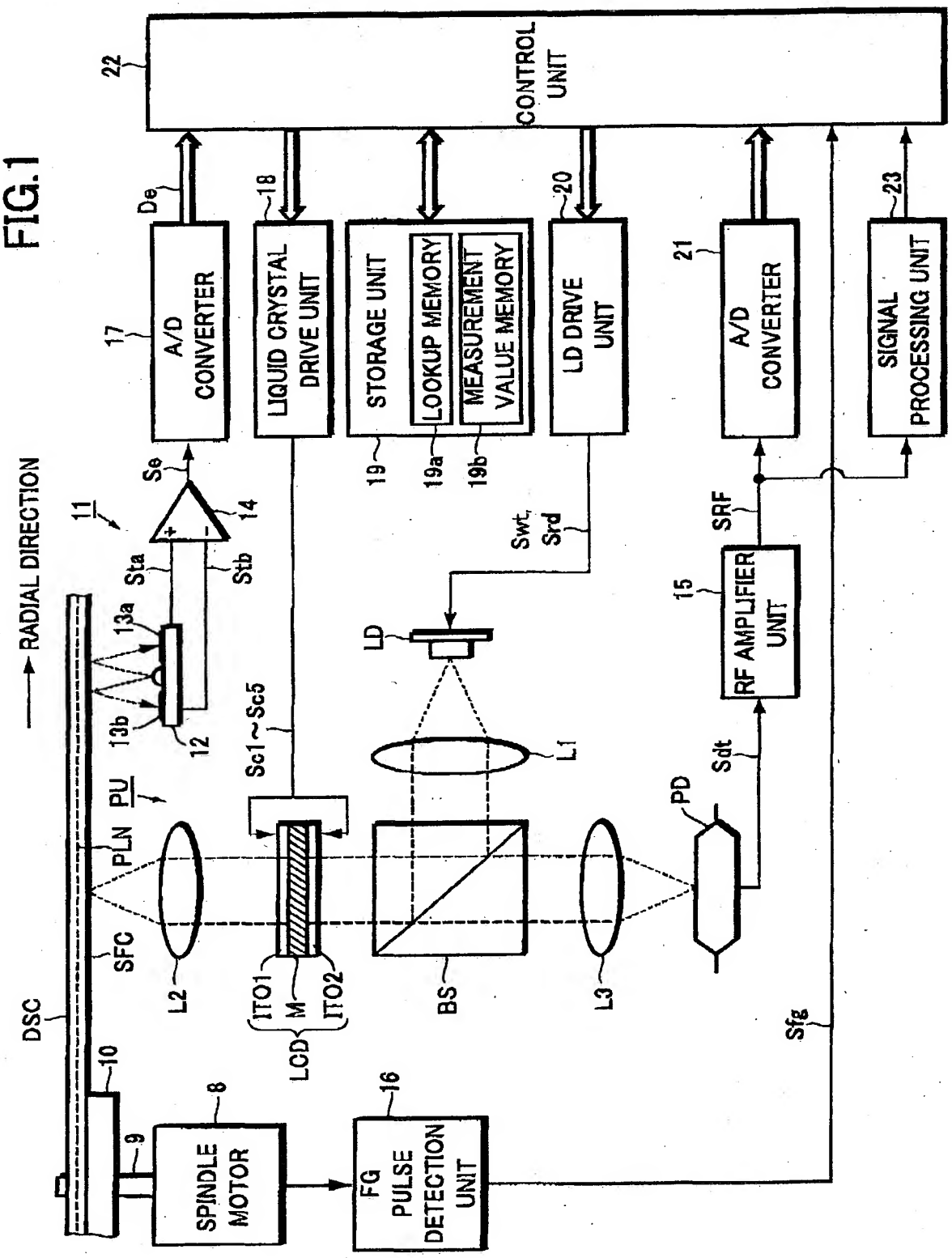

22
CONTROL UNIT
De
17
A/D CONVERTER
18
LIQUID CRYSTAL DRIVE UNIT
STORAGE UNIT
LOOKUP MEMORY
MEASUREMENT VALUE MEMORY
19
19a
19b
20
LD DRIVE UNIT
21
A/D CONVERTER
23
SIGNAL PROCESSING UNIT
Se
11
14
Sta
Stb
Swt, Srd
SRF
15
RF AMPLIFIER UNIT
RADIAL DIRECTION
13a
13b
12
LD
Sc1~Sc5
L1
PU
PLN
SFC
L2
ITO1
M
ITO2
LCD
BS
L3
PD
Sdt
DSC
10
9
8
SPINDLE MOTOR
16
FG PULSE DETECTION UNIT
Sfg

FIG.2 A

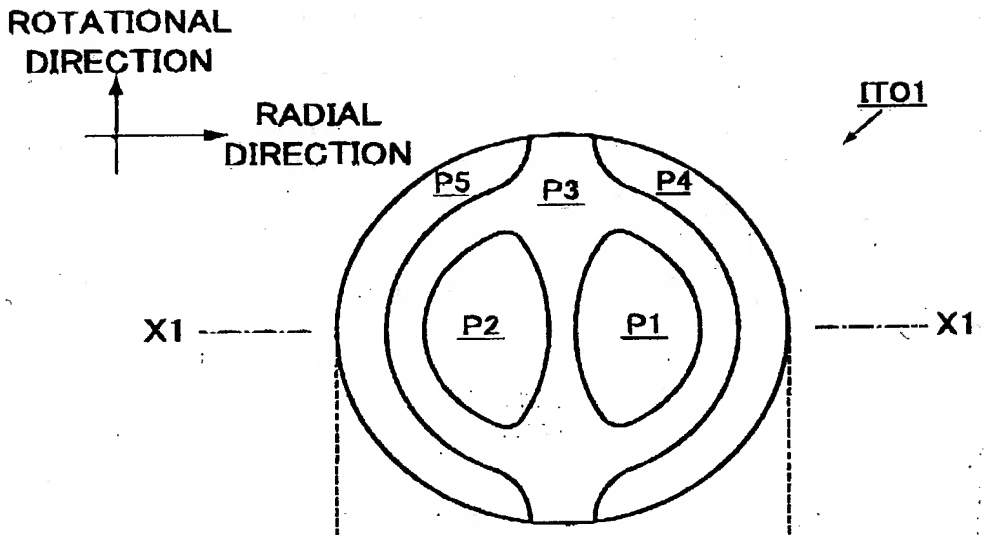

ROTATIONAL DIRECTION
RADIAL DIRECTION
ITO1
P5
P3
P4
P2
P1
X1
X1

FIG.2 B

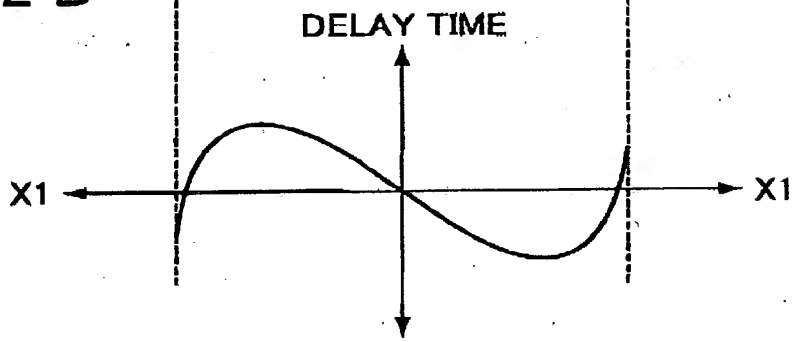

DELAY TIME
X1
X1

FIG.3 A

TILT ANGLE	PRE-MEASURED TILT ERROR DATA	VOLTAGE VALUE DATA OF PRE-MEASURED DRIVE SIGNAL
$\Delta\theta$	Der ($\Delta\theta$)	V1 ($\Delta\theta$) ~ V5 ($\Delta\theta$)
$2\times\Delta\theta$	Der ($2\times\Delta\theta$)	V1 ($2\times\Delta\theta$) ~ V5 ($2\times\Delta\theta$)
⋮	⋮	⋮
$n\times\Delta\theta$	Der ($n\times\Delta\theta$)	V1 ($n\times\Delta\theta$) ~ V5 ($n\times\Delta\theta$)
$-\Delta\theta$	Der ($-\Delta\theta$)	V1 ($-1\Delta\theta$) ~ V5 ($-\Delta\theta$)
$-2\times\Delta\theta$	Der ($-2\times\Delta\theta$)	V1 ($-2\times\Delta\theta$) ~ V5 ($-2\times\Delta\theta$)
⋮	⋮	⋮
$-n\times\Delta\theta$	Der ($-n\times\Delta\theta$)	V1 ($-n\times\Delta\theta$) ~ V5 ($-n\times\Delta\theta$)

FIG.3 B

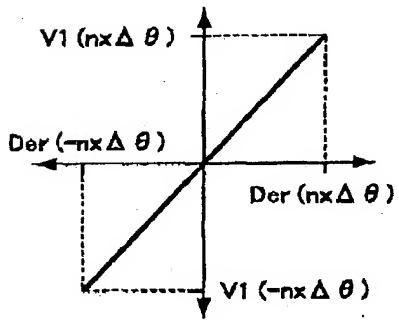


FIG.3 C

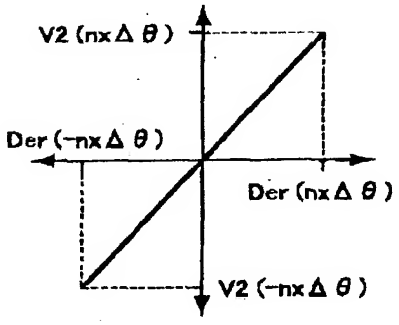


FIG.3 D

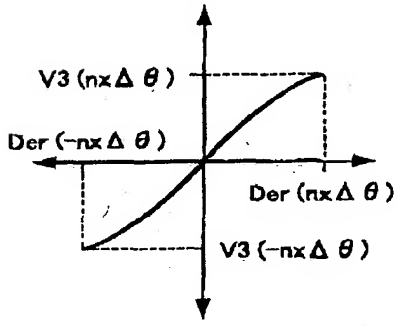


FIG.3 E

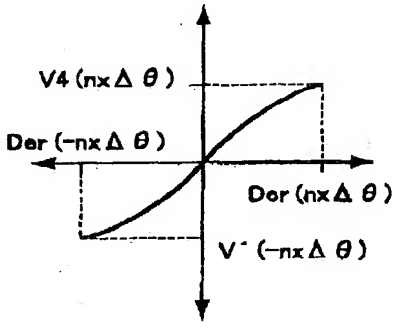


FIG.3 F

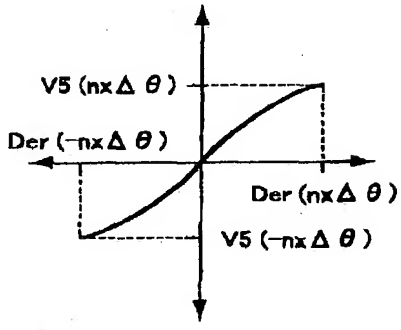


FIG.4

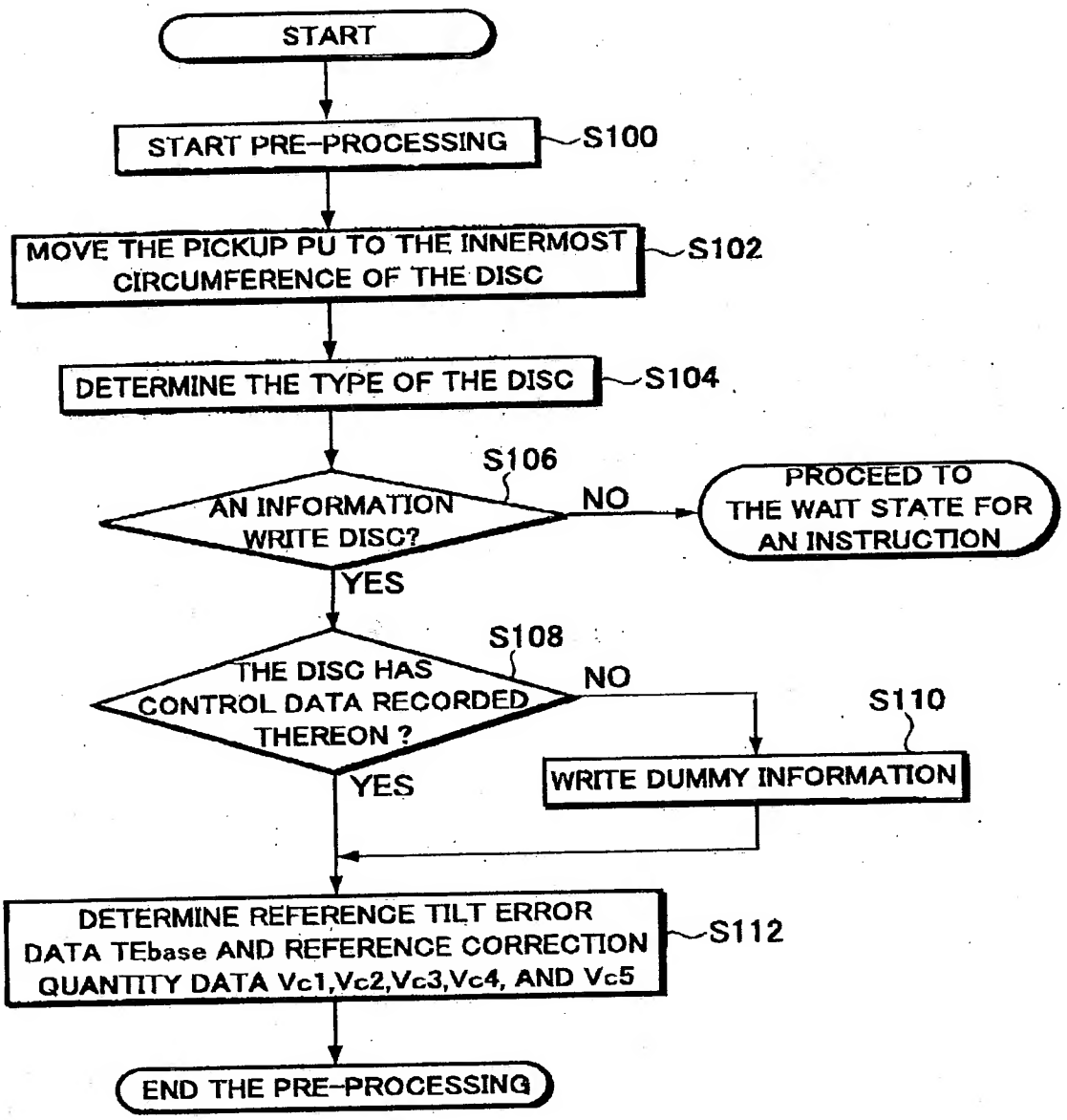

START
START PRE-PROCESSING
S100
MOVE THE PICKUP PU TO THE INNERMOST CIRCUMFERENCE OF THE DISC
S102
DETERMINE THE TYPE OF THE DISC
S104
S106
AN INFORMATION WRITE DISC?
NO
PROCEED TO THE WAIT STATE FOR AN INSTRUCTION
YES
S108
THE DISC HAS CONTROL DATA RECORDED THEREON ?
NO
S110
WRITE DUMMY INFORMATION
YES
DETERMINE REFERENCE TILT ERROR DATA TEbase AND REFERENCE CORRECTION QUANTITY DATA Vc1,Vc2,Vc3,Vc4, AND Vc5
S112
END THE PRE-PROCESSING

FIG.5

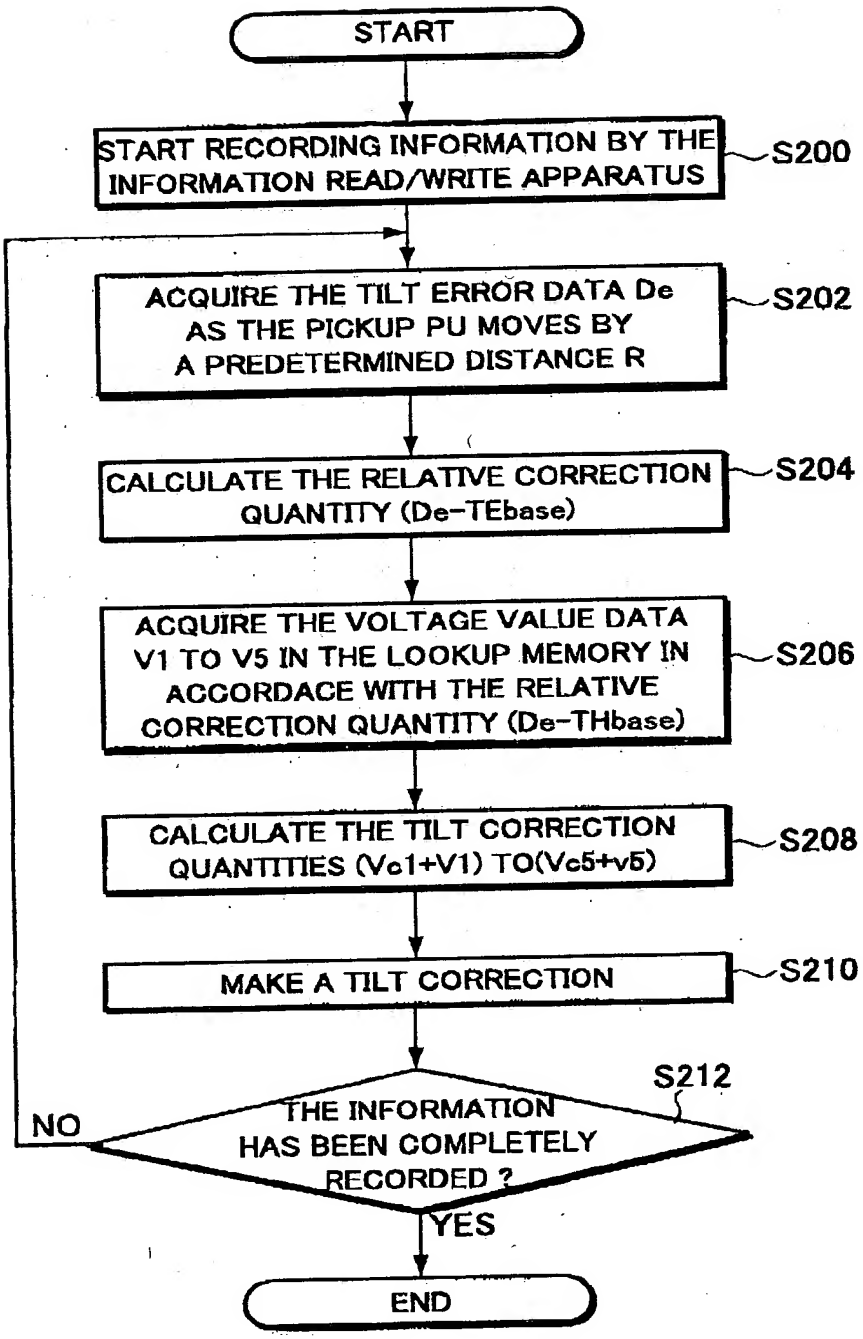

START
START RECORDING INFORMATION BY THE INFORMATION READ/WRITE APPARATUS
S200
ACQUIRE THE TILT ERROR DATA De AS THE PICKUP PU MOVES BY A PREDETERMINED DISTANCE R
S202
CALCULATE THE RELATIVE CORRECTION QUANTITY (De-TEbase)
S204
ACQUIRE THE VOLTAGE VALUE DATA V1 TO V5 IN THE LOOKUP MEMORY IN ACCORDACE WITH THE RELATIVE CORRECTION QUANTITY (De-THbase)
S206
CALCULATE THE TILT CORRECTION QUANTITIES (Vc1+V1) TO(Vc5+v5)
S208
MAKE A TILT CORRECTION
S210
S212
THE INFORMATION HAS BEEN COMPLETELY RECORDED ?
NO
YES
END

FIG.6 A

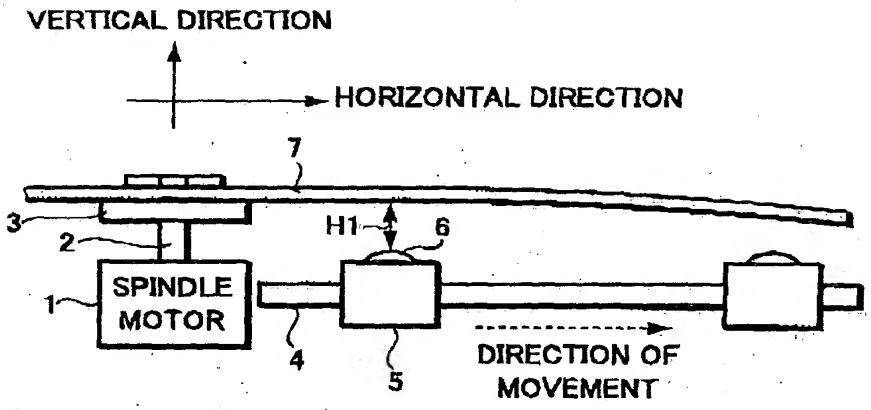


FIG.6 B

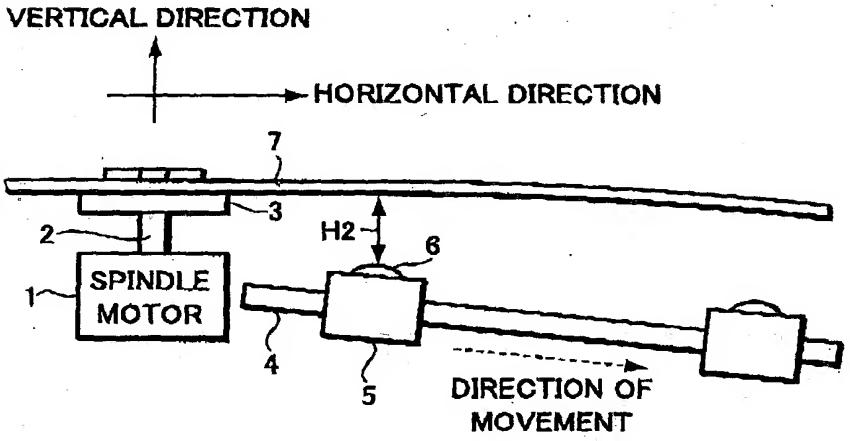


FIG.6 C

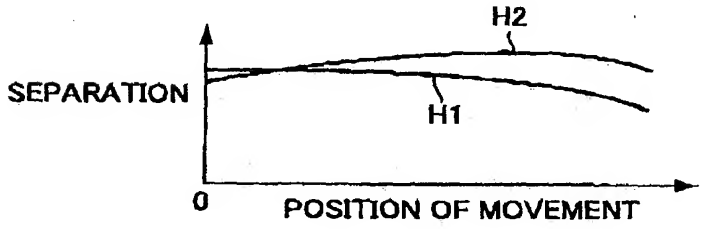


FIG.7 A

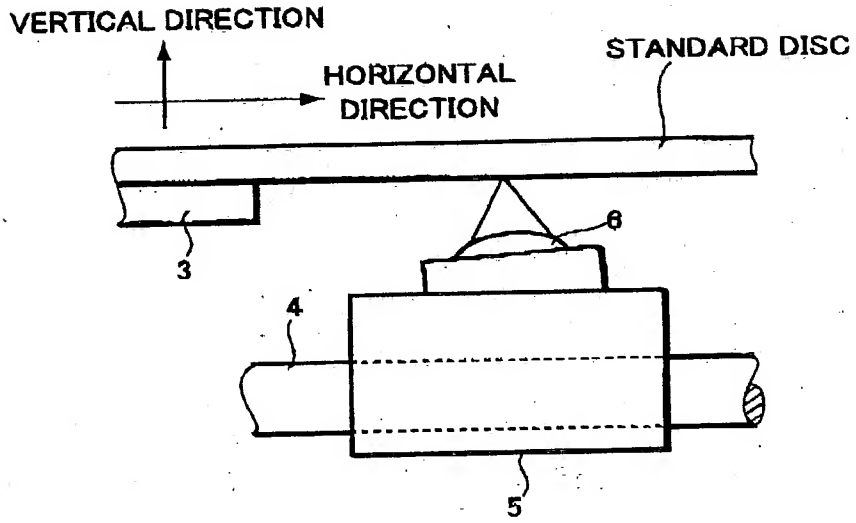

VERTICAL DIRECTION
HORIZONTAL DIRECTION
STANDARD DISC
3
4
5
6

FIG.7 B

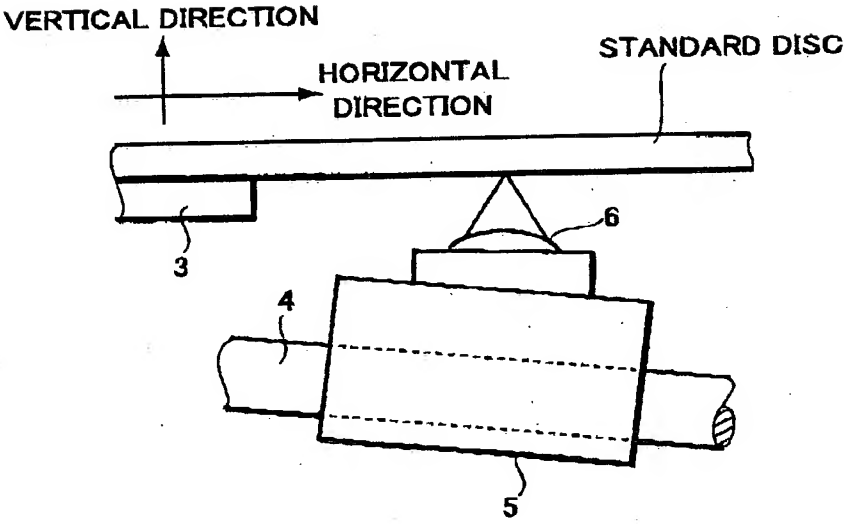

VERTICAL DIRECTION
HORIZONTAL DIRECTION
STANDARD DISC
3
4
5
6

FIG.8

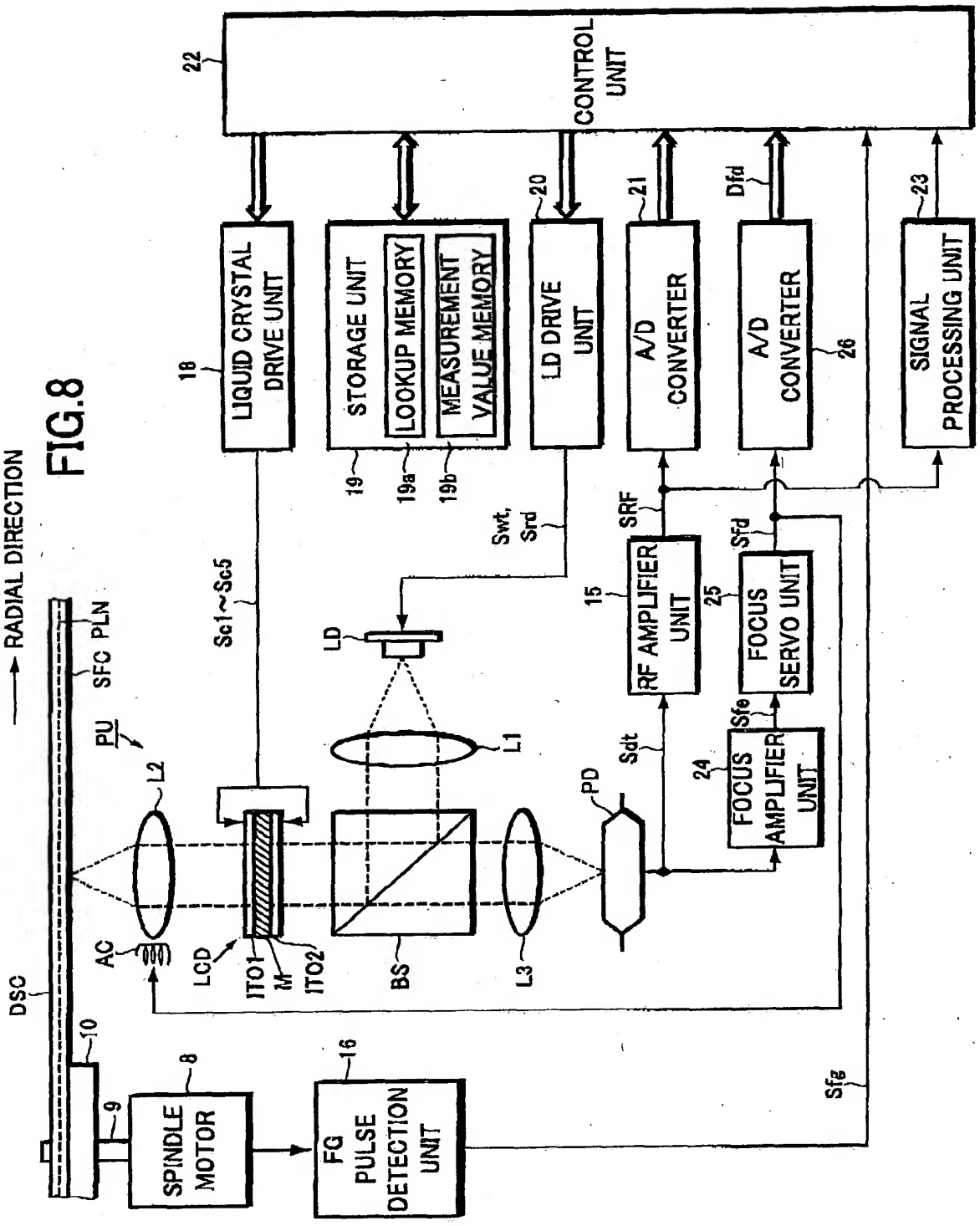

22
CONTROL UNIT
18
LIQUID CRYSTAL DRIVE UNIT
19
STORAGE UNIT
19a
LOOKUP MEMORY
19b
MEASUREMENT VALUE MEMORY
20
LD DRIVE UNIT
21
A/D CONVERTER
Dfd
A/D CONVERTER
26
23
SIGNAL PROCESSING UNIT
Swt, Srd
SRF
Sfd
15
RF AMPLIFIER UNIT
25
FOCUS SERVO UNIT
Sfe
24
FOCUS AMPLIFIER UNIT
Sdt
PD
LD
L1
L2
L3
BS
AC
LCD
ITO1
M
ITO2
Sc1~Sc5
PU
SFC PLN
RADIAL DIRECTION
DSC
10
9
8
SPINDLE MOTOR
16
FG PULSE DETECTION UNIT
Sfg

FIG.9

TILT ANGLE	VOLTAGE VALUE DATA OF PRE-MEASURED DRIVE SIGNAL
$\Delta\theta$	V1 ($\Delta\theta$) ~ V5 ($\Delta\theta$)
$2\times\Delta\theta$	V1 ($2\times\Delta\theta$) ~ V5 ($2\times\Delta\theta$)
⋮	⋮
$n\times\Delta\theta$	V1 ($n\times\Delta\theta$) ~ V5 ($n\times\Delta\theta$)
$-\Delta\theta$	V1 ($-1\Delta\theta$) ~ V5 ($-\Delta\theta$)
$-2\times\Delta\theta$	V1 ($-2\times\Delta\theta$) ~ V5 ($-2\times\Delta\theta$)
⋮	⋮
$-n\times\Delta\theta$	V1 ($-n\times\Delta\theta$) ~ V5 ($-n\times\Delta\theta$)

FIG.10

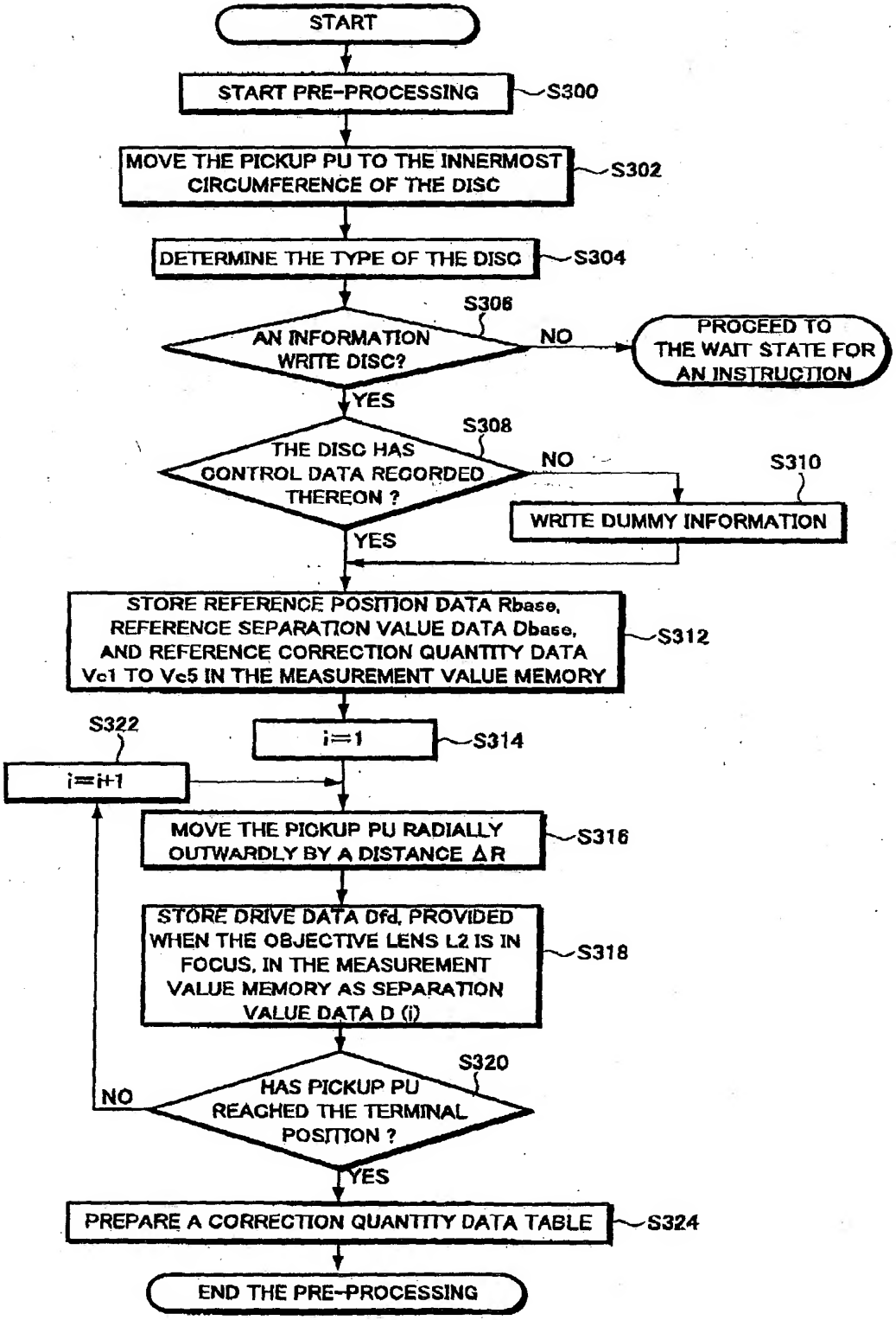

START
START PRE-PROCESSING
S300
MOVE THE PICKUP PU TO THE INNERMOST CIRCUMFERENCE OF THE DISC
S302
DETERMINE THE TYPE OF THE DISC
S304
S306
AN INFORMATION WRITE DISC?
NO
PROCEED TO THE WAIT STATE FOR AN INSTRUCTION
YES
S308
THE DISC HAS CONTROL DATA RECORDED THEREON ?
NO
S310
WRITE DUMMY INFORMATION
YES
STORE REFERENCE POSITION DATA Rbase, REFERENCE SEPARATION VALUE DATA Dbase, AND REFERENCE CORRECTION QUANTITY DATA Vc1 TO Vc5 IN THE MEASUREMENT VALUE MEMORY
S312
S322
i=i+1
i=1
S314
MOVE THE PICKUP PU RADIALLY OUTWARDLY BY A DISTANCE ΔR
S316
STORE DRIVE DATA Dfd, PROVIDED WHEN THE OBJECTIVE LENS L2 IS IN FOCUS, IN THE MEASUREMENT VALUE MEMORY AS SEPARATION VALUE DATA D (i)
S318
S320
NO
HAS PICKUP PU REACHED THE TERMINAL POSITION ?
YES
PREPARE A CORRECTION QUANTITY DATA TABLE
S324
END THE PRE-PROCESSING

FIG.11

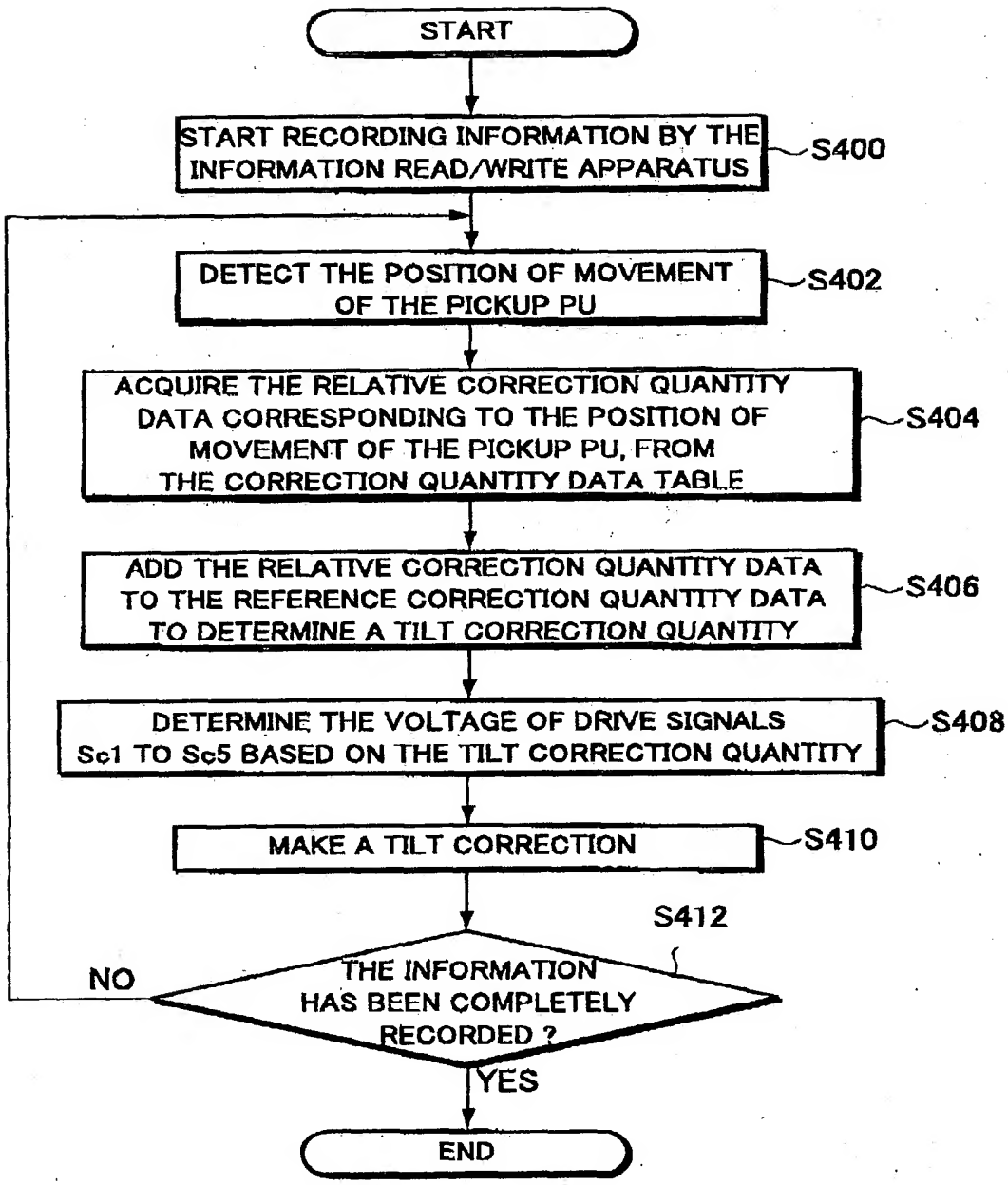

START
START RECORDING INFORMATION BY THE INFORMATION READ/WRITE APPARATUS
S400
DETECT THE POSITION OF MOVEMENT OF THE PICKUP PU
S402
ACQUIRE THE RELATIVE CORRECTION QUANTITY DATA CORRESPONDING TO THE POSITION OF MOVEMENT OF THE PICKUP PU, FROM THE CORRECTION QUANTITY DATA TABLE
S404
ADD THE RELATIVE CORRECTION QUANTITY DATA TO THE REFERENCE CORRECTION QUANTITY DATA TO DETERMINE A TILT CORRECTION QUANTITY
S406
DETERMINE THE VOLTAGE OF DRIVE SIGNALS Sc1 TO Sc5 BASED ON THE TILT CORRECTION QUANTITY
S408
MAKE A TILT CORRECTION
S410
S412
THE INFORMATION HAS BEEN COMPLETELY RECORDED ?
NO
YES
END

FIG.12

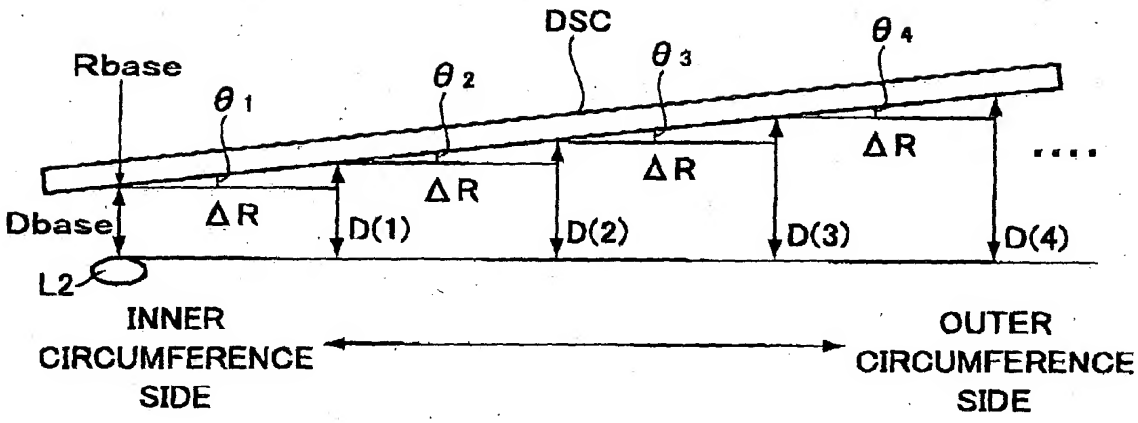

Rbase
θ1
θ2
DSC
θ3
θ4
ΔR
ΔR
ΔR
ΔR
....
Dbase
D(1)
D(2)
D(3)
D(4)
L2
INNER CIRCUMFERENCE SIDE
OUTER CIRCUMFERENCE SIDE

FIG.13

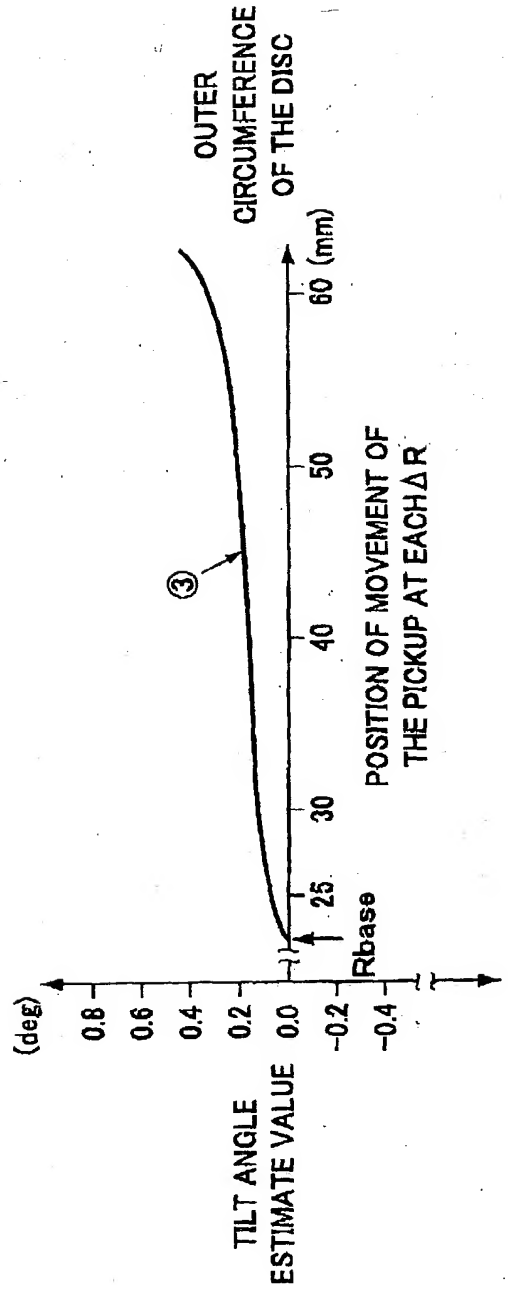
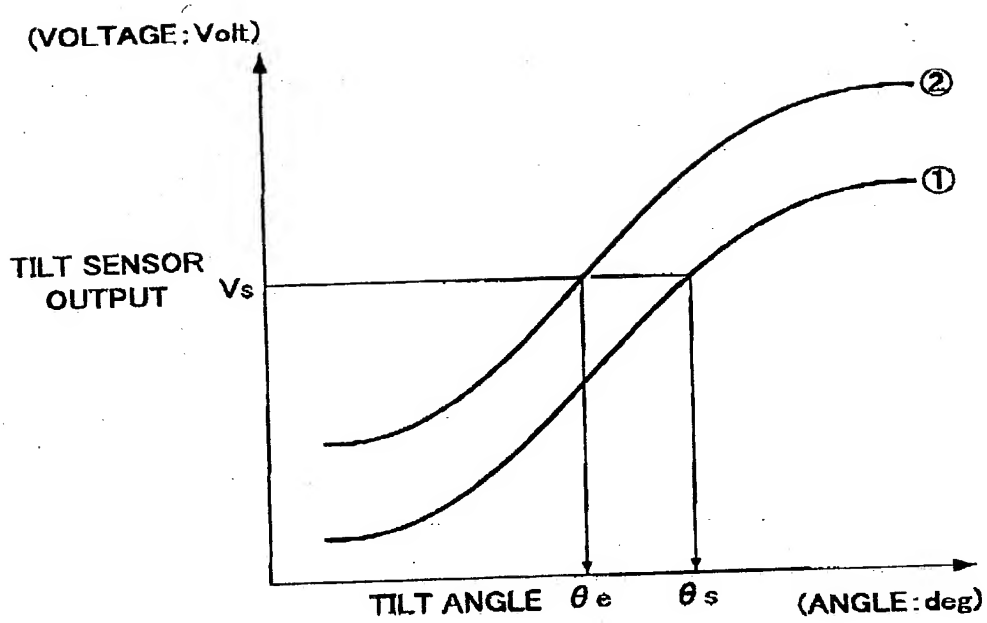

OUTER CIRCUMFERENCE OF THE DISC
60 (mm)
50
40
30
25
Rbase
POSITION OF MOVEMENT OF THE PICKUP AT EACH ΔR
③
(deg)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
TILT ANGLE ESTIMATE VALUE

FIG.14


(VOLTAGE:Volt)
②
①
TILT SENSOR OUTPUT
Vs
TILT ANGLE
θe
θs
(ANGLE:deg)